Name Saifullah

ID Number : 15660

Paper : Linear Algebra

Teacher Mansoor Qadir

Department : BS (CS 2)

Q1

Consider the given below matrix as the augmented matrix of a linear system. Explain in your words the next elemary row operation that should be performed in order to solve system. where ID3 is the 3rd digit in your ID and ID last is the last digit your ID in inverse e.g. if your ID is ~~12345~~ 15860 then -ID - last = -5

$$\begin{bmatrix} 1 & ID3 & 3 & 0 & 5 \\ 0 & 1 & -ID-last & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & ID3 \end{bmatrix}$$

Sol

Step

The given system is in echelon form so there is no need to perform further row operation.

$(0)w + (0)x + (0)y + (1)z = 8 \Rightarrow z = 8$

$(0)w + (0)x + (1)y + (0)z = -6$

$\boxed{y = -6}$

$(0)w + (1)x + (0)y + (0)z = 7$

$\boxed{x = 7}$

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Put eqn and (ii) and (iii) below

$w + 8x + 3y + (0)7 = 5$

$w + 8(7) + 3(-6) + 0(8) = 5$

$w + 56 - 18 + 0 = 5$

$w = -56 + 18 + 5$

$w = -56 + 23$

$\boxed{w = -33}$

finally:

$w = -33$

$x = 7$

$y = -6$

$z = 8$

Q2

P(a)

Find the elementary row that transform the first matrix into second and reverse row operation that transform the second matrix into first

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & -5 & -1 \end{bmatrix} \quad \begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & 3 & -5 \end{bmatrix}$$

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(3)

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & 5 & -1 \end{bmatrix} \quad \begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & 3 & -5 \end{bmatrix}$$

matrix 2 + matrix 2

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & -5 & -1 \end{bmatrix}$$

$R_3 - 2R_2$

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2-2 & -5+8 & -4+1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & 3 & -5 \end{bmatrix}$$

matrix 2 to matrix (1)

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & 3 & -5 \end{bmatrix}$$

$R_2 + 2R_2$

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$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0+2 & 3+(-2) & -5+4 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & -5 & -1 \end{bmatrix}$$

So this matrix (1)

P(b)

Below given are some matrices. Find the which one is the row echelon from and which is reduced row echlon from. Explain in your own words for each of the selection in detail.

(a)

$$\begin{bmatrix} e & 0 & 0 & 0 \\ 0 & \pi & 0 & 0 \\ 0 & 0 & -\pi & 0 \\ 0 & 0 & 0 & e \end{bmatrix}$$

is the echlon form.

The echelon form because A matrix Should be in echlon form.

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if zero lies below the pivate or if zero row lies below the non-zero rows!

→ In this case lies below every key entry and in each successive non-zero row, the number of zero before the 1st non-zero entry of a row increases row by row.

(b)

1	0	π
0	1	e
0	0	0
0	0	0

→ If zero lies below and above the pivote is called Reduced Echelon form.
→ The pivate of reduced echlon from should be 1.
In this case all the properties are satefied so it is reduced echelon form.

(c)

$$\begin{bmatrix} 5 & 0 & 0 & 7 \\ 0 & 1 & 0 & 5 \\ 0 & 0 & 0 & 4 \end{bmatrix}$$

↓

Write the answer of part "a" here.

(d)

$$\begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

is not in reduce echelon form because. It is neccessary that for reducede echelon form a matrix should be in Row echelon form. and the given matrix is not in reduce echlon form.

— x — x — x —

Q 3

The row echelon form is used to solve the system of linear equation.

Q(a)

What is the difference between the row echelon and reduced row echelon form? What is the Parcitial use of reduced row echelon form? Give one exmple.

Row echelon form:-

A mxn matrix "A" is said to be In (row) echelon form (or an echelon matrix)if it satisfies the following Properties.

⇒ In each successive non-zero row, the number of zero before the 1st non zero entry of a row increases row by row

⇒

Every non-zero in "A" Preceed every zero row (if there is any)

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Example

$$\begin{bmatrix} 2 & 3 & -4 & 1 \\ 0 & 1 & 5 & 3 \\ 0 & 0 & 0 & 6 \end{bmatrix} \qquad \begin{bmatrix} 0 & 2 & 3 \\ 0 & 0 & -5 \\ 0 & 0 & 0 \end{bmatrix}$$

Reduced echelon form:-

An $m \times n$ matrix "A" is said to be in reduced (row) echelon form or (reduced echelon matrix if satisfies the following ~~Pro~~ Properties.

→ It is in (row) echelon form.

→ The first non-zero entry in R_i lies is C_j is 1 and all other matries of C_j are zero.

Examples

$$\begin{bmatrix} 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

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Q3

P(b)

Find an echelon form for the below matix using row operation. where ID2 is 2nd digits in your ID e.g. if your is ~~12345~~ 15860 ID2 = 2, ID3 = 3 ID - first last is the first and last digit of your ID i.e. 15

$$\begin{bmatrix} 1 & 5 & 8 \\ 2 & 8 & -1 \\ -8 & 0 & 0 \\ 1 & -4 & 10 \end{bmatrix}$$ Reduce to echelon form.

Sol:

$$\underset{\sim}{R} \begin{bmatrix} 1 & 5 & 8 \\ 0 & -2 & -17 \\ 1 & -4 & 10 \\ -8 & 0 & 0 \end{bmatrix} \begin{matrix} \\ R_2 - 2R_1 \\ R_3 \leftrightarrow R_4 \\ \\ \end{matrix}$$

$$\underset{\sim}{R} \begin{bmatrix} 1 & 5 & 8 \\ 0 & -2 & -17 \\ 0 & -9 & 2 \\ 0 & 40 & 64 \end{bmatrix} \begin{matrix} \\ \\ R_3 - R_1 \\ R_4 - 8R_1 \end{matrix}$$

+

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$$R \sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & -1 & -17/2 \\ 0 & -9 & 3/2 \\ 0 & -40 & -61 \end{bmatrix} \quad -1/2 \; R_2$$

$$R \sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & -1 & -17/2 \\ 0 & 0 & 157/2 \\ 0 & 0 & 276 \end{bmatrix} \begin{matrix} \\ \\ R_3 - 9R_2 \\ R_4 - 40R_2 \end{matrix}$$

$$R \sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & -1 & -17/2 \\ 0 & 0 & 1 \\ 0 & 0 & 276 \end{bmatrix} \quad \frac{2}{157} \; R_3$$

$$R \sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & -1 & -17/2 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \quad R_4 - 276 R_3$$

Echelon form of the give matrix.

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